

N-channel 100V, 3.4mΩ max., 230A
 SGT MOSFET M1 in TOLL

Datasheet - Preliminary data

1. Descriptions

Key Performance Parameters

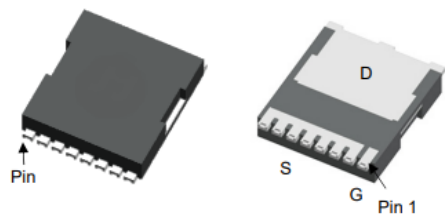
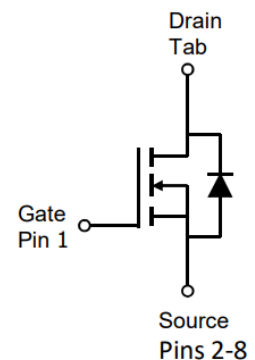
Parameters	Value	Unit
BV_{DSS}	100	V
$R_{DS(on),max}$	3.4	mΩ
$Q_{g,type}$	70	nC
$I_{D,pulse}$	920	A
E_{AS}	238	mJ

Features

- Extremely low losses due to very low FOM $R_{dson} \cdot Q_g$.
- High-speed switching.
- Qualified for industrial grade applications according to JEDEC.
- 100% UIS Tested.

Applications

High-Efficiency DC-DC Converters, Switching Voltage Regulators and Motor Drivers.

TOLL

Schematic Diagram


Type/Ordering Code	Package	Marking	Related Links
CST034N10M1	TOLL	034N10M1	See Appendix A

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2. Maximum Ratings

at $T_j = 25^\circ\text{C}$, unless otherwise specified

Table 1. Absolute Maximum Ratings

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
V_{DS}	Drain-source voltage ¹⁾	-	-	100	V	$V_{GS}=0V$, $I_D=250\mu A$
I_D	Continuous drain current	-	-	230	A	$T_C=25^\circ\text{C}$
$I_{D,pulse}$	Pulsed drain current	-	-	920	A	$T_C=25^\circ\text{C}$
E_{AS}	Avalanche energy, single pulse ²⁾	-	-	238	mJ	$I_D=69A$; $V_{DD}=50V$
I_{AS}	Avalanche current	-	-	69	A	-
V_{GS}	Gate source voltage	-20	-	20	V	static; AC ($f>1\text{ Hz}$)
P_{tot}	Power dissipation	-	-	375	W	$T_C=25^\circ\text{C}$
T_j, T_{stg}	Operating and storage temperature	-55	-	175	$^\circ\text{C}$	-
I_S	Continuous diode forward current	-	-	230	A	$T_C=25^\circ\text{C}$
$I_{S,pulse}$	Diode pulse current	-	-	920	A	$T_C=25^\circ\text{C}$

1) Limited by T_j max. Maximum duty cycle $D=0.75$.

2) $V_{DD}=50V$, $L=0.1mH$, $R_G=25\Omega$, Starting $T_j=25^\circ\text{C}$.

3. Thermal Characteristics

Table 2. Thermal Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
R_{thJC}	Thermal resistance, junction - case	-	0.4	0.5	°C/W	$T_C = 25^{\circ}\text{C}$
R_{thJA}	Thermal resistance, junction - ambient	-	45	55	°C/W	$T_C = 25^{\circ}\text{C}$
T_{sold}	Soldering temperature, wavesoldering only allowed at leads	-	-	260	°C	Lead Temperature (Soldering, 10 sec)

4. Electrical Characteristics

at $T_j = 25^\circ\text{C}$, unless otherwise specified

Table 3. Static Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-source breakdown voltage	100	-	-	V	$V_{GS}=0V, I_D=250\mu A$
$V_{(GS)th}$	Gate threshold voltage	2	2.8	4	V	$V_{DS}=V_{GS}, I_D=250\mu A$
I_{DSS}	Zero gate voltage drain current	-	-	1	μA	$V_{DS}=100V, V_{GS}=0V, T_j=25^\circ C$
I_{GSS}	Gate-source leakage current	-	-	± 100	nA	$V_{GS}=\pm 20V, V_{DS}=0V$
$R_{DS(on)}$	Drain-source on-state resistance	-	2.8	3.4	m Ω	$V_{GS}=10V, I_D=20A, T_j=25^\circ C$
R_G	Gate resistance	-	2.5	-	Ω	$V_{DD}=0V, V_{GS}=0V, F=1MHz$
g_{fs}	Transconductance		85		S	$V_{DS}=5V, I_D=20A$

Table 4. Dynamic Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
C_{iss}	Input capacitance	-	4300	-	pF	$V_{GS}=0V, V_{DS}=50V, f=1MHz$
C_{oss}	Output capacitance	-	1050	-	pF	$V_{GS}=0V, V_{DS}=50V, f=1MHz$
C_{rss}	Reverse transfer capacitance	-	5	-	pF	$V_{GS}=0V, V_{DS}=50V, f=1MHz$
$t_{d(on)}$	Turn-on delay time	-	11	-	ns	$V_{DD}=50V, V_{GS}=10V, I_D=20A, R_G=6\Omega$
t_r	Rise time	-	22	-	ns	$V_{DD}=50V, V_{GS}=10V, I_D=20A, R_G=6\Omega$
$t_{d(off)}$	Turn-off delay time	-	68	-	ns	$V_{DD}=50V, V_{GS}=10V, I_D=20A, R_G=6\Omega$
t_f	Fall time	-	47	-	ns	$V_{DD}=50V, V_{GS}=10V, I_D=20A, R_G=6\Omega$

Table 5. Gate Charge Characteristics

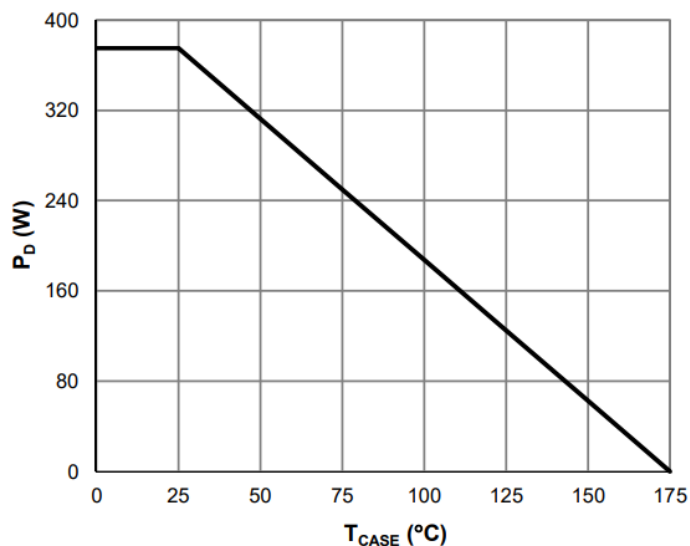
Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
Q_{gs}	Gate to source charge	-	12.5	-	nC	$V_{DD}=50V, I_D=20A, V_{GS}=0 \text{ to } 10V$
Q_{gd}	Gate to drain charge	-	19	-	nC	$V_{DD}=50V, I_D=20A, V_{GS}=0 \text{ to } 10V$
Q_g	Gate charge total	-	70	-	nC	$V_{DD}=50V, I_D=20A, V_{GS}=0 \text{ to } 10V$
$V_{plateau}$	Gate plateau voltage	-	3.8	-	V	$V_{DD}=50V, I_D=20A, V_{GS}=0 \text{ to } 10V$

Table 6. Reverse Diode Characteristics

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
V_{SD}	Diode forward voltage	-	-	1.2	V	$V_{GS}=0V, I_F=15A, T_j=25^\circ C$
t_{rr}	Reverse recovery time	-	64	-	ns	$V_R=50V, I_F=15A, di_F/dt=100A/\mu s$
Q_{rr}	Reverse recovery charge	-	72	-	nC	$V_R=50V, I_F=15A, di_F/dt=100A/\mu s$

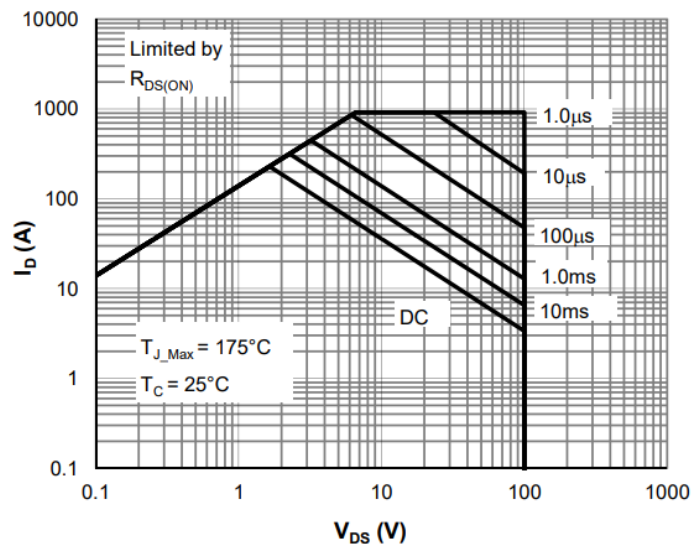
5. Electrical Characteristics Diagrams

Diagram 1: Power dissipation



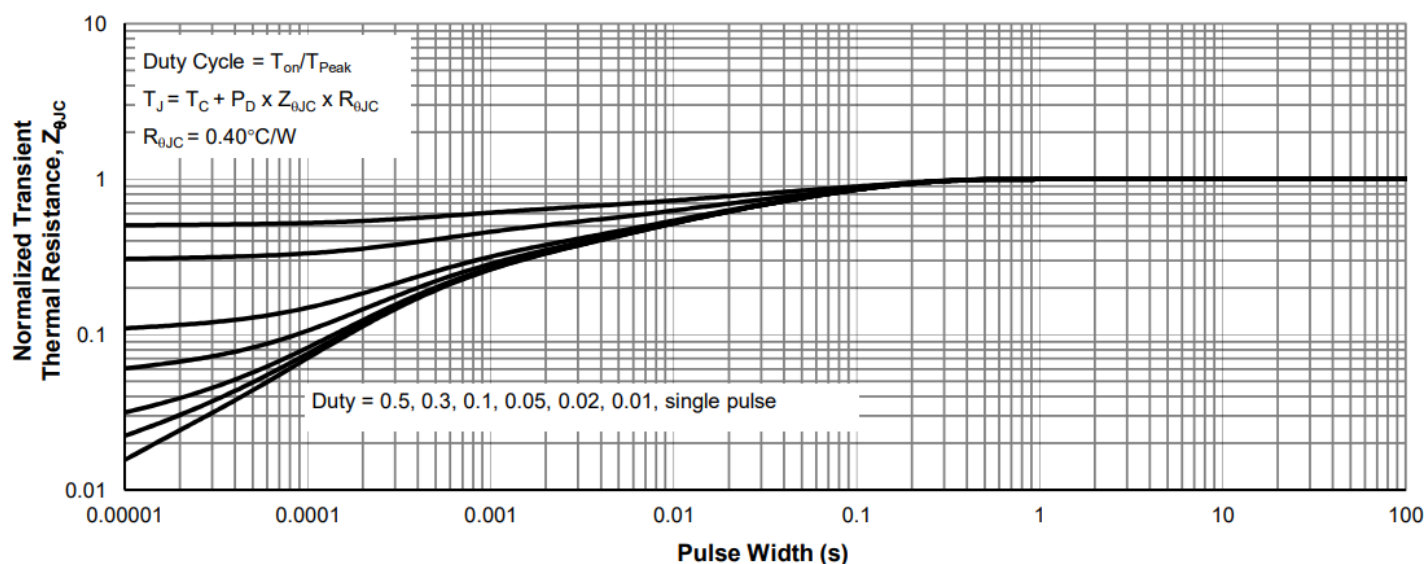
$$P_{tot}=f(T_C)$$

Diagram 2: Max. Safe operating area



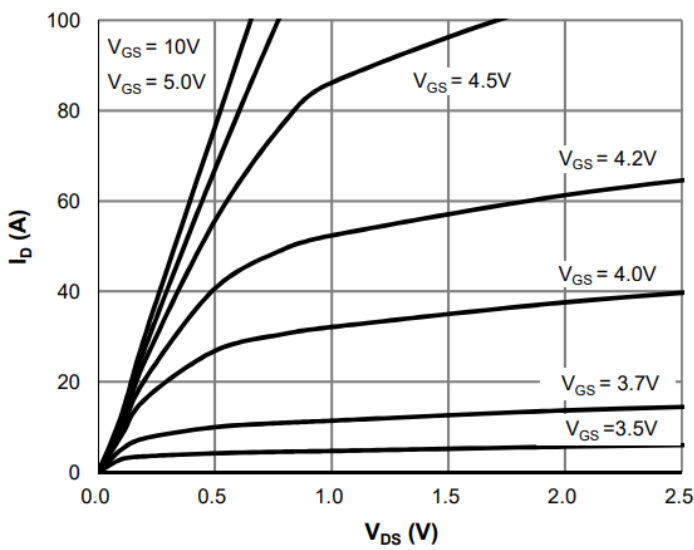
$$I_D=f(V_{DS})$$

Diagram 3: Normalized Maximum Transient Thermal Impedance



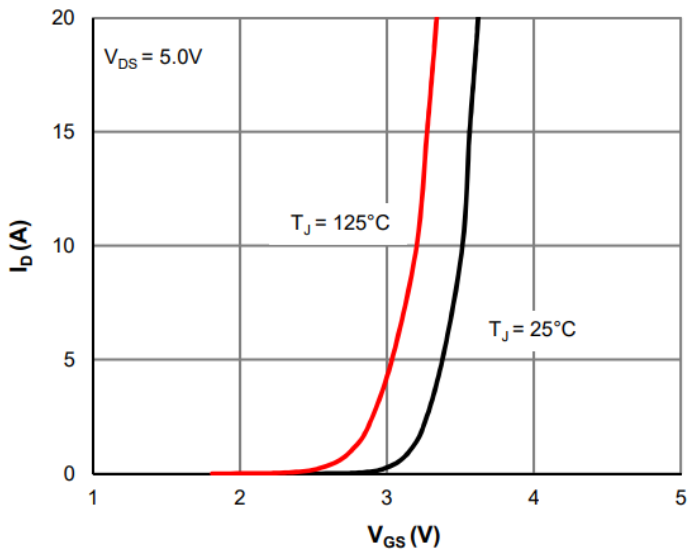
$$Z_{thJC}=f(t_p)$$

Diagram 4: Typ. output characteristics



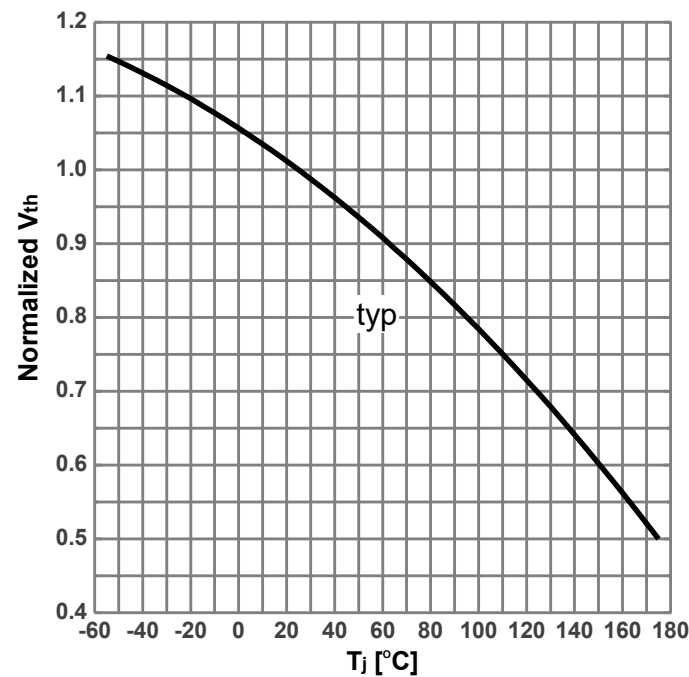
$I_D=f(V_{DS})$; $T_J=25^{\circ}\text{C}$; parameter: V_{GS}

Diagram 5: Typ. transfer characteristics



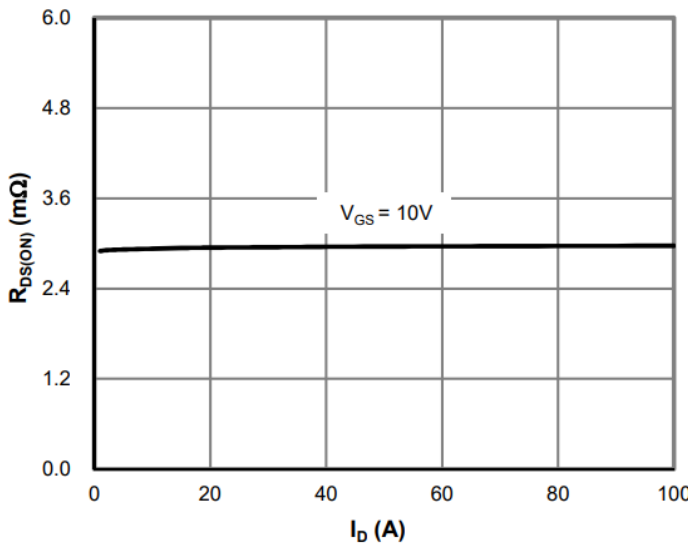
$I_D=f(V_{GS})$; $V_{DS}=5\text{V}$; parameter: T_J

Diagram 6: Gate threshold voltage vs. Junction temperature



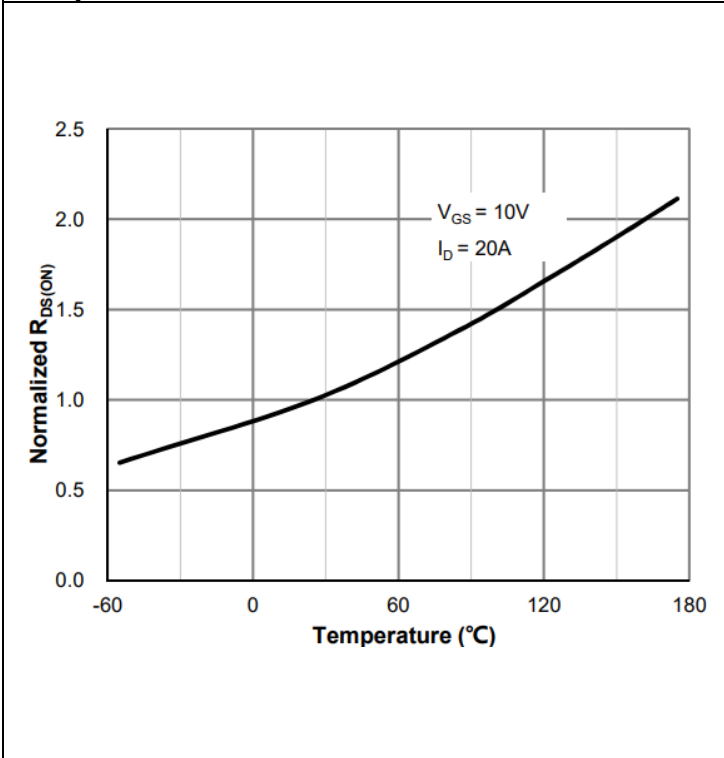
$V_{th}=f(T_J)$; $I_D=250\mu\text{A}$

Diagram 7: On-state resistance vs. Drain current



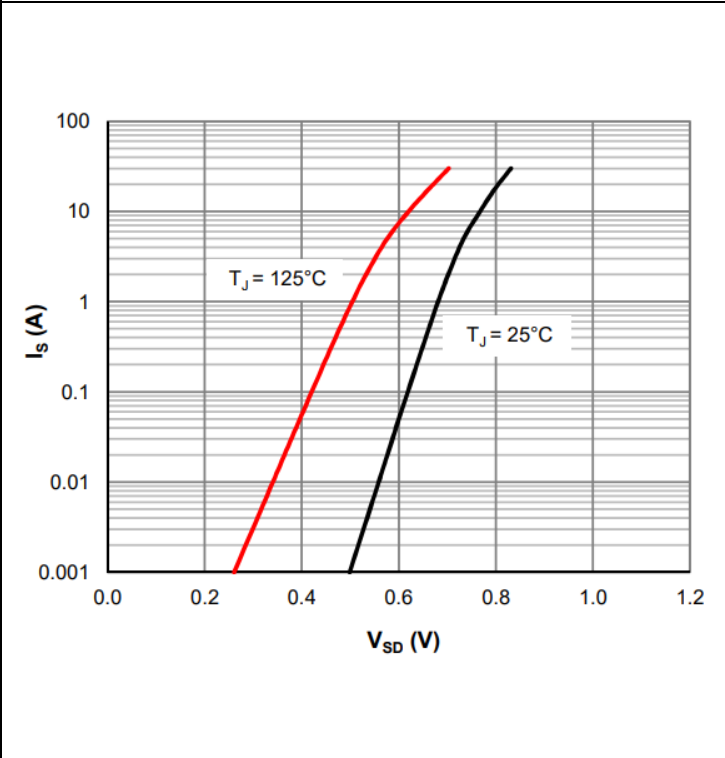
$R_{DS(on)}=f(I_D)$; $T_J=25^{\circ}\text{C}$; parameter: V_{GS}

Diagram 8: On-state resistance vs. Junction temperature



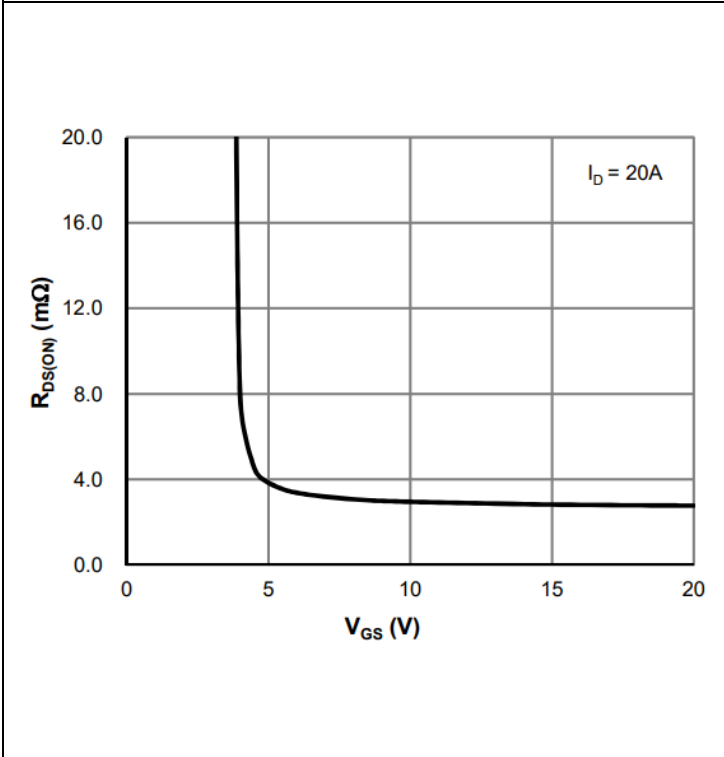
$R_{DS(on)}=f(T_j); I_D=20A; V_{GS}=10V$

Diagram 9: Forward characteristics of reverse diode



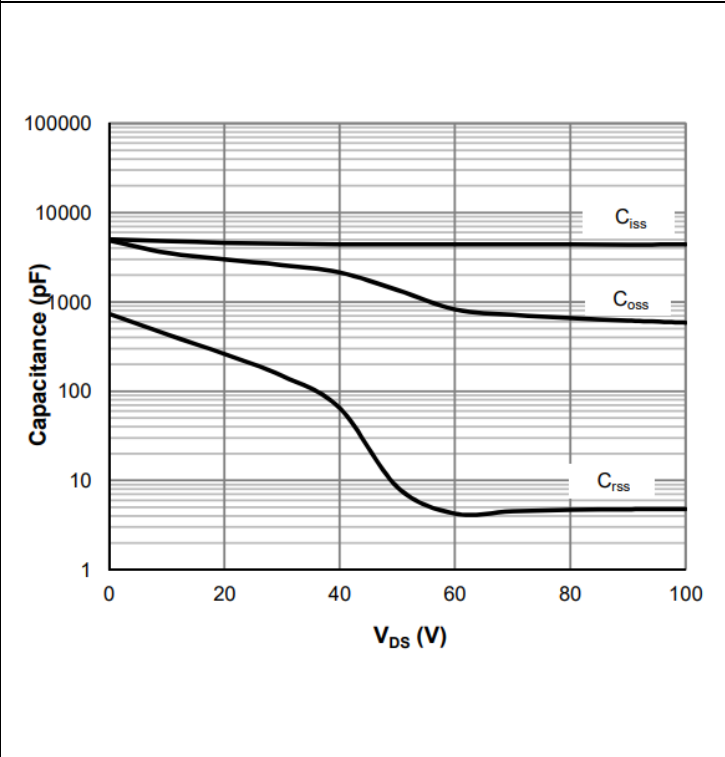
$I_S=f(V_{SD})$

Diagram 10: On-state resistance vs. V_Gs characteristics



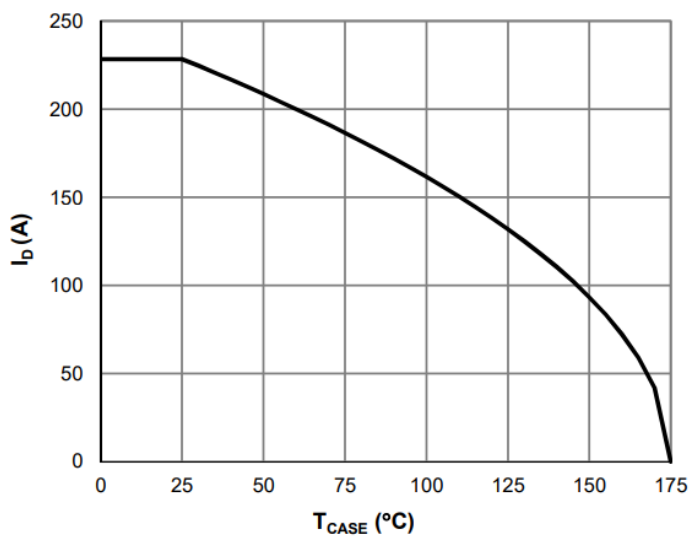
$R_{DS(on)}=f(V_{GS}); T_J=25^{\circ}C; I_D=20A$

Diagram 11: Typ. capacitances



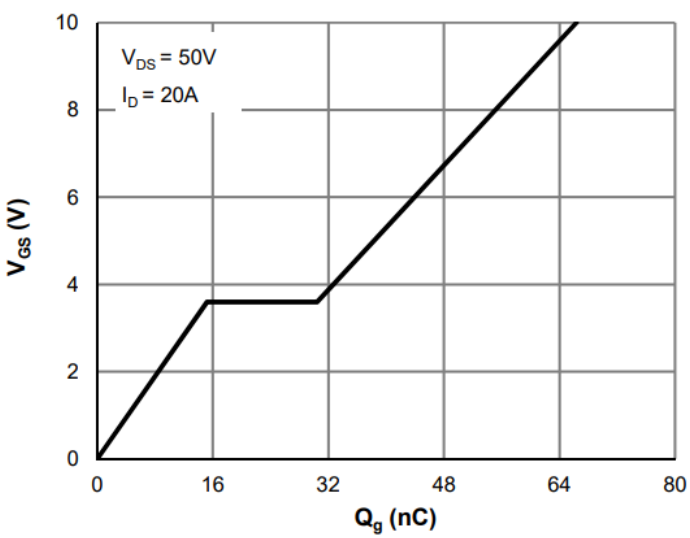
$C=f(V_{DS}); V_{GS}=0V; f=1MHz$

Diagram 12: Maximum Drain Current



$I_D = f(T_c); V_{GS} = 10V$

Diagram 13: Typ. gate charge



$V_{GS} = f(Q_{gate}); I_D = 20A$ pulsed; $V_{DS} = 50V$

6. Test Circuits

Table 7. Diode Characteristics

Table 1: Diode Characteristics	Table 2: Diode Recovery Characteristics
Test circuit for diode characteristics $R_{g1} = R_{g2}$	Diode recovery waveform $t_{rr} = t_f + t_s$ $Q_{rr} = Q_F + Q_S$

Table 8. Switching Times

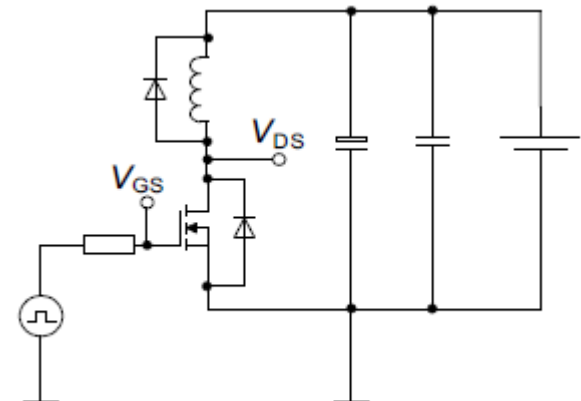
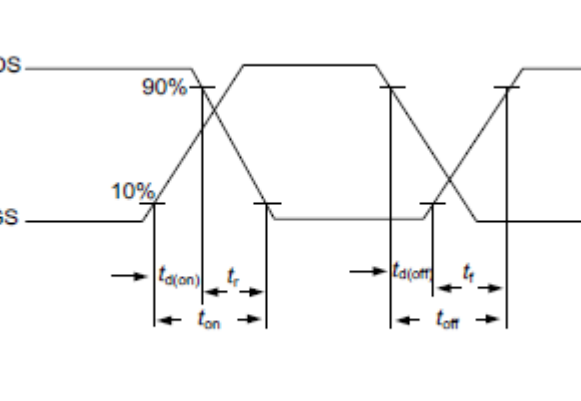
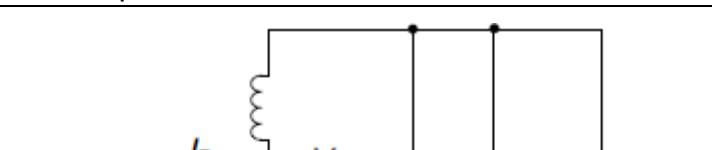
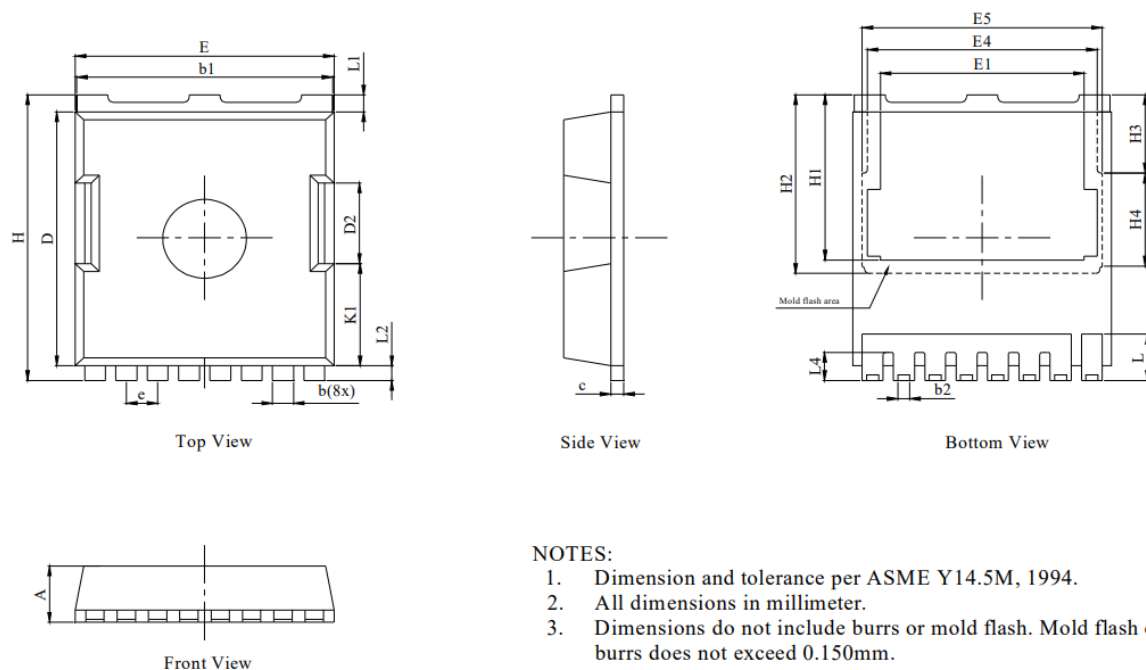
Switching times test circuit for inductive load	Switching times waveform
	

Table 9. Unclamped Inductive Load

Unclamped inductive load test circuit 	Unclamped inductive waveform 
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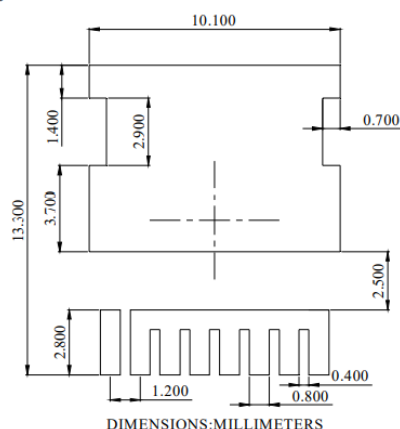
7. Package Outlines

Figure 1 Outline TOLL Dimensions in mm



DIM.	MILLIMETER		
	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b2	0.42	0.46	0.50
c	0.40	0.50	0.60
D	10.28	10.38	10.58
D2		3.30	
E	9.70	9.90	10.10
E1		7.80	
E4		8.80	
E5		9.20	
e	1.20 (BSC)		
H	11.48	11.68	11.88
H1	6.55	6.75	6.85
H2		7.30	
H3		3.20	
H4		3.80	
K1		4.18	
L	1.70	1.90	2.10
L1		0.70	
L2		0.60	
L4	1.00	1.15	1.30

Recommended Soldering Footprint



8. Appendix

CoolSemi Webpage: www.coolsemi.com.